

GAMMA MIXTURE DENSITY NETWORKS AND THEIR APPLICATION TO MODELLING INSURANCE CLAIM AMOUNTS

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ABSTRACT. We start with giving a motivation why actuaries should consider mixtures of Gamma distributions for non-life pricing. We focus on developing techniques how mixtures of Gamma distributions with mixing probabilities, shape and rate parameters depending on features can be fitted with neural networks. We propose two versions of the Expectation-Maximization algorithm for fitting so-called Gamma Mixture Density Networks, which we call the EM network boosting algorithm and the EM forward network algorithm. A simulation study shows that our algorithms perform very well on synthetic data sets. We further illustrate the application of the Gamma Mixture Density Network on a real data set of motor insurance claim amounts and conclude that Gamma Mixture Density Networks can improve the fit of the regression model and the predictions of the claim severities used for rate-making compared to classical actuarial techniques. Finally, we discuss possible generalizations of the presented pricing model.

This is a joint work with Mario Wuethrich (ETH Zurich) and Mathias Lindholm (Stockholm University).

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